Fig. IV-4-5 - Hydraulic calculations of upstream head above invert bed for box culverts with inlet control

(Concrete Pipe Association of Australasia 1991, p. 39)

Example

\[ D = 600 \text{ mm} \]
\[ Q/B = 1.40 \text{ m}^3/\text{sm} \]

\[ \frac{HW}{D} \quad \text{HW(m)} \]

(1) 1.75 1.0
(2) 1.90 1.1
(3) 2.04 1.2

HW scale Wingwall flare

(1) 30° to 75°
(2) 90° and 15°
(3) 0° (extensions of sides)

To use scale (2) or (3) project horizontally to scale (1), then use straight inclined line through D and Q scales, or reverse as illustrated.
Fig. IV-4-6 - Hydraulic calculations of total head losses for concrete box culverts flowing full (i.e. drowned) (Concrete Pipe Association of Australasia 1991, p. 41)

**ENERGY HEAD H FOR CONCRETE BOX CULVERTS FLOWING FULL**

\( n = 0.011 \)

**FIGURE 3.6**

ADAPTED FROM [3.4]

**NOTE:**
(a) For a different value of \( n \), use the length scale shown with an adjusted length \( L' = L(n/n) \).
(b) For a different value of \( k_s \) connect the given length on adjacent scales by a straight line and select a point on this line spaced from the two chart scales in proportion to the \( k_s \) values.
(c) For areas less than 0.3m² and boxes with width to height ratios greater than 2 or less than 1, determine \( H \) from

\[
H = [1 + k_s + \frac{19.62}{n^2}] \frac{Q^2}{R^{4/3}} \frac{2ga^2}{2gA^2}
\]